

REMARKS

At the time the Final Office Action issued, claims 1 to 7 and claims 9 to 12 were pending. Claims 1 to 7 currently stand rejected. Claims 9 to 12 have been allowed, and Examiner is respectfully thanked for having allowed these claim. Claims 2-4 and 6 have been identified as containing allowable subject matter, and Examiner is also thanked for having made such identification.

Claim amendments

The amendments above, as will be respectfully explained below, are intended to fully comply with the requirements explicitly set forth in the Final Office Action and thereby to bring the application in a condition ready for allowance. Entry of the amendments is thus respectfully requested.

Solely in the interest of patent term on the allowable claims, Attorney for Applicant presently rewrites claims 2, 4, and 6 as independent claims as indicated by the Examiner, by replacing the reference to claim 1 by the full subject matter of claim 1. This does not constitute a limitation of claims 2, 4, and 6 since the subject matter was already incorporated in these claims by virtue of reference.

In addition, the reference to claim 1 in claims 5 and 7 has been changed to a reference to claim 2, since claim 1 has been canceled and its subject matter is in claim 2. Claim 1 has been canceled.

No subject matter has been added.

Drawings

Amended drawings have been filed in our latest response of 13 March 2007 following objections made by the Examiner. However, no positive indication of acceptance has been made by the Examiner since no box has been marked in response to item 10 on the Office Action Summary. Applicant assumes that the drawings are now acceptable, as the drawings have not been objected to in the present application. Attorney for Applicant respectfully requests confirmation of acceptance for Record.

Claim rejections

Claims 1, 5, and 7 have been rejected. Each of these claims is ultimately dependent on claim 1.

The rejections have become moot by cancellation of claim 1, and by amendment of any reference to claim 1 in claims 5 and 7 to reference to an allowed claim.

However, it is made explicit for the record that Applicants do not agree with the rejection of claim 1 and respectfully submit that the cancellation of claim 1 is made without prejudice and under explicit reservation of full rights to prosecute the subject matter of claims 1, 5 and/or 7 in one or more divisional applications or continuation applications.

Substitute Specification

While responding to the present Final Action, it was noticed that the preliminary amendment of 6 January 2005 left some grammatically incorrect sentences (see e.g. "Upon alternating the flow direction of the system 30." in the paragraph starting at line 14 of page 5; and e.g. the last sentence of page 3). Moreover, it was noticed that paragraphs were made part of "Summary of the invention" which according to US practice do not belong in that section.

In order to correct these matters of formal nature, entry of the enclosed Substitute Specification is respectfully requested. A marked-up version has been enclosed as well, showing changes relative to the immediate prior version of the Specification of Record, including amendments made on 6 January 2005 and 13 March 2007. No new matter has been added.

As Examiner can verify, the corrections include the following:

A) The paragraph starting on page 6 line 1, in the clean version of the substitute specification, is inserted to replace the second paragraph from the Summary of the Invention section. The paragraph, which is based on page 1 lines 2-17 of the International application as filed, was inadvertently put in the Summary of the Invention by way of the amendment of 6 January 2005 whereas it clearly does not belong there.

B) The paragraphs starting on page 3 line 1 and ending on page 4 line 14 are based on the original description of the International Application, starting page 2 line 1 and ending on page 3 line 13. These paragraphs were originally not part of any "Summary of invention" section in the International application, but were inadvertently included in such a section as a result of the preliminary amendment of 6 January 2005.

C) The line "Upon alternating the flow direction of the system 30." that resulted from the preliminary amendment of 6 January 2005 in the paragraph starting at original line 14 of original page 5, has been removed.

D) The sentence directly preceding "BRIEF DESCRIPTION OF THE DRAWING", which became incomplete as a result of inserting this heading in our preliminary amendment of 6 January 2005, has been corrected to form a complete sentence.

The substitute specification does not include added matter.

Entry of the substitute specification is respectfully requested, even though the Examiner has not expressly requested a substitute specification. Attorney believes that the

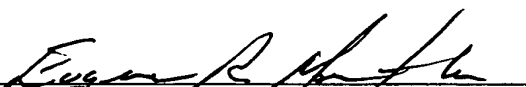
review of the corrections does not impose a substantial amount of work on the part of the Examiner.

Concluding remarks

Attorney has addressed each and every ground for objection and rejection raised by the Examiner in the Office Action. Attorney respectfully submits that the specification and claims, as amended, are now in a state ready for allowance. In the event the Examiner has any questions or issues regarding the present application, the Examiner is invited to call the undersigned prior to the issuance of any written action.

Respectfully submitted,

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TS 6331 US-substitute specification



CHOKE FOR CONTROLLING THE FLOW OF DRILLING MUD

PRIORITY CLAIM

The present application claims priority on European Patent Application 02254746.7 filed 8 July 2002.

BACKGROUND OF THE INVENTION

5 The present invention is related to a drilling system, more particularly, a system for controlling formation pressure while drilling.

According to prior art systems, the pressure is controlled by pumping fluid into the bore hole, via the
10 annulus. Such a drilling fluid outlet system could further comprise a safety choke, in case the pump fails.

However due to large rock debris or contaminated mud, the safety choke could get clogged or could be damaged, which jeopardises correct control over the pressure in
15 the well bore.

SUMMARY OF THE INVENTION

The invention relates to a drilling system for drilling a well bore into an earth formation, comprising:

- drilling means for drilling a well bore;
- 20 - pumping means for pumping drilling fluid into the well bore during drilling; and
- a drilling fluid outlet system for retrieving drilling fluid from the well bore.

~~Such a drilling system is for example known from WO 00 79092. In this publication it is disclosed that the drilling fluid outlet system is used to maintain control over the fluid pressure at the well bore wall, especially when drilling is stopped or during tripping of the drill string out of the bore hole. Without~~

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~~maintaining control over the pressure, there is a potential danger that undesired fluid flows from the earth formation into the bore hole, or that the borehole wall collapses.~~

5 It is an object of the invention to alleviate the disadvantages of the prior art and to provide a system that is capable of regulating the pressure while the flow may contain large rock debris or contaminated mud.

10 This object is achieved by a drilling fluid outlet system comprising choke means for choking the returned flow of retrieved drilling fluid and alternating means for alternating the flow direction through the choke means.

15 ~~— So if the choke means would get clogged, the returned flow is alternated, such that the choke means are cleaned and the debris is discharged.~~

20 ~~— According to a preferred embodiment the drilling fluid outlet system comprises an inlet and an outlet, the choke means comprise a first inlet/outlet connection, a second outlet/inlet connection and the alternating means connect the inlet alternately to the first or second connection and the outlet alternately to the second or first connection. So with these alternating means it is possible to connect the choke means such that the inlet~~
25 ~~is used as an inlet or outlet and that at the same time the outlet is used as outlet or inlet.~~

30 ~~— In another embodiment of the drilling system according to the invention filter means are arranged in the first and second connection of the choke means.~~

~~— These filter means block large pieces, which could damage the choke means. Upon alternating the flow direction blocked pieces at the filter means are discharged.~~

~~— In again another embodiment of the drilling system according to the invention, the alternating means comprise a four way valve, having four connections and wherein the connections are connected two by two. With~~
5 ~~such a valve, which could be actuated automatically, alternating of the flow is performed quickly. This will provide a minimum interruption of the flow.~~

~~— Preferably the drilling fluid outlet system comprises an accumulator. This accumulator secures a constant flow~~
10 ~~at the moment that the flow direction is alternated.~~

~~— In yet another embodiment of the drilling system according to the invention, the choking means comprises a bi directional choke. Such a bi directional choke provides a choking action in both flow directions. This~~
15 ~~provides for a compact design.~~

~~— In another embodiment the choking means comprise at least two uni directional chokes. Such uni directional chokes provide a choking action in only one flow direction. Therefore two chokes are necessary to provide~~
20 ~~a choking action in both flow directions.~~

The invention relates also to a drilling fluid outlet system.

In another aspect the invention relates to a method of drilling a well bore into an earth formation.

25 In accordance with this aspect of the invention, the method comprises:

- drilling the well bore by operating drilling means;
- pumping drilling fluid into the well bore during said drilling; and
- 30 - retrieving drilling fluid from the well bore in a drilling fluid outlet system, said drilling fluid outlet system comprising choke means for choking the return flow of retrieved drilling fluid, whereby the flow direction

of retrieved drilling fluid through the choking means is alternated for flushing away any debris from the choke means.

5 The invention will be now illustrated by way of example and in conjunction with the accompanying drawings, ~~wherein.~~

BRIEF DESCRIPTION OF THE DRAWING

In the accompanying drawing:

10 Figure 1 shows a schematic view of a drilling system according to the invention;

Figure 2 shows a schematic view of a first embodiment of a drilling fluid outlet system according to the invention; and

15 Figure 3 shows a second embodiment of a drilling fluid outlet system according to the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

20 Described is a drilling system comprising an drilling fluid outlet system that comprises choke means for choking the returned flow of retrieved drilling fluid and alternating means for alternating the flow direction through the choke means.

So if the choke means would get clogged, the returned flow is alternated, such that the choke means are cleaned and the debris is discharged.

25 According to a preferred embodiment, the drilling fluid outlet system comprises an inlet and an outlet, the choke means comprise a first inlet/outlet connection, a second outlet/inlet connection and the alternating means connect the inlet alternately to the first or second
30 connection and the outlet alternately to the second or first connection. So with these alternating means it is possible to connect the choke means such that the inlet

is used as an inlet or outlet and that at the same time the outlet is used as outlet or inlet.

In another embodiment of the drilling system according to the invention, filter means are arranged in the first and second connection of the choke means.

These filter means block large pieces, which could damage the choke means. Upon alternating the flow direction blocked pieces at the filter means are discharged.

In again another embodiment of the drilling system according to the invention, the alternating means comprise a four way valve, having four connections and wherein the connections are connected two by two. With such a valve, which could be actuated automatically, alternating of the flow is performed quickly. This will provide a minimum interruption of the flow.

Preferably, the drilling fluid outlet system comprises an accumulator. This accumulator secures a constant flow at the moment that the flow direction is alternated.

In yet another embodiment of the drilling system according to the invention, the choking means comprises a bi-directional choke. Such a bi-directional choke provides a choking action in both flow directions. This provides for a compact design.

In another embodiment the choking means comprise at least two uni-directional chokes. Such uni-directional chokes provide a choking action in only one flow direction. Therefore two chokes are necessary to provide a choking action in both flow directions.

Figure 1 shows a schematic view of a drilling system 1 according to the invention. With this drilling

system 1 a well bore 2 is drilled into the earth formation 3.

The drilling system 1 comprises a frame 4 onto which a fluid chamber 5 is slidably arranged along a guide 6.

5 A drill string 7 with on its bottom end a drill bit 8 is rotated by a top drive 9 in order to drill the well

bore 2. The well bore 2 is partially lined with a casing 10. The drill string 7 is composed out of a plurality of drill string joints 11, which are

10 interconnected by connectors 12a and 12b. Drill mud contained in a reservoir 13 is pumped by pump 14 into the drill string 7 to the drill bit 8. The drilling mud 25 flows into the annulus between the well bore wall and the drill string 7 upwards. The annulus is closed off by

15 a rotating blow out preventer 15. The drilling mud is returned via pipe 16 and drilling fluid outlet system 17 back to the reservoir 13. When connecting another drill string joint 11 the feed of drilling mud is taken over by pump 18, which pumps the drilling fluid into the

20 chamber 5, such that it can flow into the drill string 7.

The drilling fluid outlet system 17 ensures that a certain pressure is maintained in the well bore 2 by choking the flow in the pipe 16.

In Figure 2 the drilling fluid outlet system 17 is shown in more detail. The system 17 comprises a valve 20 and a bi-directional choke 21. In the position of the valve 20 as shown in figure 2 the inlet pipe 16 is

25 connected to the first connection pipe 22 of the choke 21. The outlet pipe 19 is connected to the second connection 23 of the choke 21. When the choke 21 gets

30 clogged, the valve 20 is rotated, such that the inlet pipe 16 is connected to the second connection 23 of the choke 21 and the outlet pipe 19 is connected to the first

connection 22 of the choke 21. In this way the flow direction is alternated and any debris, which is clogging the choke 21 is flushed away through outlet pipe 19.

5 In Figure 3 a second embodiment 30 of a drilling fluid outlet system according to the invention is shown. The system 30 again comprises a valve 31 and two uni-directional chokes 32 and 33. Such chokes 32,33 have a choking action in just one flow direction. Furthermore, the system 30 comprises filter means 34,35 that filters
10 large debris in the mud, which could damage the chokes 32,33. An accumulator 36 is connected to the inlet pipe 16, which ensures that a constant flow is maintained while the flow direction of the system 30 is alternated by turning the valve 31. ~~Upon alternating the flow~~
15 ~~direction of the system 30.~~ Any debris present on the filter means 34,35 or in the chokes 32,33 is cleaned by alternating the flow direction of the system 30 and is flushed away through outlet pipe 19.

It is remarked that WO-00 79092, for example,
20 discloses a drilling system for drilling a well bore into an earth formation, comprising:

- drilling means for drilling a well bore;
- pumping means for pumping drilling fluid into the well bore during drilling; and

25 - a drilling fluid outlet system for retrieving drilling fluid from the well bore. The drilling fluid outlet system is used to maintain control over the fluid pressure at the well bore wall, especially when drilling is stopped or during tripping of the drill string out of
30 the bore hole. Without maintaining control over the pressure, there is a potential danger that undesired fluid flows from the earth formation into the bore hole, or that the borehole wall collapses.

While the illustrative embodiments of the invention have been described with particularity, it will be understood that various other modifications will be readily apparent to, and can easily be made by one skilled in the art without departing from the spirit of the invention. Accordingly, it is not intended that the scope of the following claims be limited to the examples and descriptions set forth herein but rather that the claims be constructed as encompassing all features which would be treated as equivalents thereof by those skilled in the art to which this invention pertains.

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